Paper No. 20

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte ROSS ADDINALL
and
GARETH RHYS DAVIES

Appeal No. 2004-1842
Application No. 09/639,288

ON BRIEF

Before McQUADE, NASE, and BAHR, Administrative Patent Judges.
NASE, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1 to 3 and 7 to 10. Claims 11 and 12 are allowed. Claims 5 and 6 have been objected to as depending from a non-allowed claim. Claim 4 is pending.[1] No claim has been canceled.

We AFFIRM-IN-PART.

[1] In the answer (p. 2), the examiner withdrew the rejection of claims 1 to 4 and 7 to 10 under 35 U.S.C. § 102(e). Accordingly, no rejection of claim 4 is before us in this appeal.

BACKGROUND

The appellants' invention relates to integrated circuit dies (specification, p. 1). A copy of the dependent claims under appeal is set forth in the appendix to the appellants' brief. Claims 1 and 8, the independent claims on appeal, read as follows:

> 1. An integrated circuit die including first and second sets of conductive pads for enabling external connections to be made to the integrated circuit, wherein each pad of said first set is larger than each pad of said second set, there being at least a first predetermined center-to-center spacing between each pad of the first set and the adjacent pad or pads of the first set, and at least a second predetermined center-to-center spacing, less than said first spacing, between each pad of the second set and the adjacent pad or pads of the first and second sets, and a passivation layer exposing only pads of the first set, or exposing pads of the first and second sets.
>
> 8. An integrated circuit die, comprising:
> a first set of conductive pads having a first minimum distance therebetween; and
> a second set of conductive pads having a second minimum distance therebetween, and between a pad of the second set and a neighboring pad of the first set, wherein each pad of said first set is larger than each pad of said second set;
> wherein the die is adapted for selective use as one of a flip-chip assembly and a wire bond.

Claims 1 to 3 and 8 to 10 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,641,946[2] to Shim.

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[2] Issued June 24, 1997.

Claim 7 stands rejected under 35 U.S.C. § 103 as being unpatentable over Shim.

Rather than reiterate the conflicting viewpoints advanced by the examiner and the appellants regarding the above-noted rejections, we make reference to the answer (Paper No. 13, mailed July 30, 2003) for the examiner's complete reasoning in support of the rejections, and to the brief (Paper No. 12, filed December 10, 2002) and reply brief (Paper No. 15, filed October 3, 2003) for the appellants' arguments thereagainst.

OPINION

In reaching our decision in this appeal, we have given careful consideration to the appellants' specification and claims, to the Shim patent, and to the respective positions articulated by the appellants and the examiner. As a consequence of our review, we make the determinations which follow.

The anticipation rejection

We sustain the rejection of claims 1 to 3 and 8 to 10 under 35 U.S.C. § 102(b) as being anticipated by Shim.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. Verdegaal Bros. Inc. v. Union Oil Co., 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir.), cert. denied, 484 U.S. 827 (1987). The inquiry as to whether a reference anticipates a claim must focus on what subject matter is encompassed by the claim and what subject matter is described by the reference. As set forth by the court in Kalman v. Kimberly-Clark Corp., 713 F.2d 760, 772, 218 USPQ 781, 789 (Fed. Cir. 1983), cert. denied, 465 U.S. 1026 (1984), it is only necessary for the claims to "'read on' something disclosed in the reference, i.e., all limitations of the claim are found in the reference, or 'fully met' by it."

Shim's invention relates in general to a method and circuit board structure for leveling solder balls in BGA (ball grid array) semiconductor packages with solder ball input and output terminals. More particularly, Shim's invention relates to a method and circuit board structure for improving coplanarity of a BGA package's solder ball array caused by thermal bending of the circuit board generated during a high temperature processing step of a BGA semiconductor package producing process. It is an object of Shim's invention to level the tops of the solder balls, which will be brought into contact with a mother board when a BGA semiconductor package is mounted to the mother board, by adjusting the size of solder ball lands used for welding the solder balls to the

PCB, thereby achieving the coplanarity of the solder balls regardless of thermal bending of the plastic body and PCB of the BGA semiconductor package. In order to accomplish the above object, Shim's invention levels the tops of the solder balls by either designing solder ball lands having different sizes or forming differently-sized exposed inside portions of solder ball lands using an insulating mask after forming the solder ball lands of the same size on the PCB.

Figures 5A and 5B of Shim show solder ball lands 5 formed on the circuit board 1 of the BGA package. A solder ball 3 is formed on each solder ball land and is welded to the circuit board 1. The solder ball lands 5 have different sizes depending on the thermally bent configuration and bending angle of the circuit board 1 of the package. When the BGA semiconductor package is thermally bent causing the top center of the package to be convexed thereby causing bad coplanarity of the solder ball array as shown in Figure 1A, the solder ball lands 5 are designed as follows. The outside lands 5 are designed to be larger than the inside lands 5 as shown in Figure 5A. When the package is thermally bent causing the top center of the package to be concaved thereby causing bad coplanarity of the solder ball array as shown in Figure 1B, the outside lands 5 are designed to be smaller than the inside lands 5 as shown in Figure 6.

Figure 7 of shim is a partially enlarged view of the circuit board 1 of Figure 5A. The circuit board 1 is thermally bent causing the top center of the board 1 to be convexed as described for the circuit board of Figure 5A. The size of the solder ball lands 5 are gradually reduced in such a manner that the outermost solder ball lands "a" have the largest size, while the innermost land "d" has the smallest size.

In Shim's first method for forming the solder ball landing area suitable for compensating for the bad coplanarity of the solder ball array, a plurality of solder ball lands having different sizes are primarily formed on the circuit board 1 by etching the metal part of the circuit board 1. After forming the above solder ball lands, a mask (see insulating mask 6 depicted in Figure 11) is formed on the area of the circuit board 1 except for portions with the solder ball lands 5. Thereafter, a plurality of solder balls 3 are formed on the solder ball lands 5 in the above state. The solder ball lands 5 are thereby formed on the circuit board 1 as shown in Figures 9A, 9B, 10A and 10B. In this case, the sizes of the solder ball lands 5 are different from each other in accordance with the thermally bent configuration and bending angle of the circuit board 1. That is, the solder ball lands 5 may be designed in such a manner that the outermost land 5 is larger or smaller than the innermost land 5 as described above.

Figure 11 of Shim shows the solder balls 3 which are seated on the above solder ball lands 5 and subjected to reflow. When a solder ball B_1 is formed on the largest solder ball land 5 having the largest diameter d_1, the solder ball B_1 is largely deformed as the solder ball B_1 on the largest land 5. In this regard, the height of the solder ball B_1 is significantly reduced from the original height H to the final height h_1. That is, the solder ball B_1 formed on the largest solder ball land 5 becomes the lowest solder ball. On the other hand, when a solder ball B_3 is formed on the smallest solder ball land 5 having the smallest diameter d_3, the solder ball B_3 is scarcely deformed as the solder ball B_3 on the smallest land 5 has the smallest welding area. In this regard, the height of the solder ball B_3 is scarcely reduced from the original height H to the final height h_3. That is, the solder ball B_3 formed on the smallest solder ball land 5 becomes the highest solder ball.

As described above, the bad coplanarity of the solder ball array of a BGA semiconductor package due to the thermal bending of the circuit board 1 can be compensated for by forming the solder ball lands 5 which have different diameters in accordance with portions of the thermally bent circuit board 1. With the different sizes of the solder ball lands 5, the height of the solder balls 3 formed on the solder ball lands 5 can be adjusted in order to bring all of the solder balls 3 into uniform contact with a mother board when the BGA package is mounted to the mother board.

Claim 8

We agree with the examiner that the subject matter of claim 8 is readable on Shim as set forth in the rejection under appeal.

The appellants argue that Shim discloses a uniform center-to-center spacing between all of the lands 5 and thus does not disclose a first set of conductive pads having a first minimum distance therebetween and a second set of conductive pads having a second minimum distance therebetween and between a pad of the second set and a neighboring pad of the first set. The appellants also argue that Shim does not anticipate claim 8 since Shim discloses more than two sets of conductive pads and that embodiment of Shim disclosed in Figures 5-11 does not include a passivation layer.

We find these arguments of the appellants unpersuasive for the following reasons. First, claim 8 does not recite a passivation layer. Second, we agree with the examiner (see Exhibit A of the answer) that the claimed first set of conductive pads is readable on Shim's outermost ring of lands 5 having a diameter of d_1 (colored in blue in Exhibit A) and that the claimed second set of conductive pads is readable on Shim's lands 5 having a diameter of d_2 or d_3 within the outermost ring of lands (colored in yellow in Exhibit A). We see nothing in this comprising-type of claim from excluding claim 8 from being interpreted in this manner. Moreover, even if Shim's lands 5 having

a diameter of d_2 were considered to be a second set of conductive pads and Shim's lands 5 having a diameter of d_3 were considered to be a third set of conductive pads, the appellants have not explained how claim 8 distinguishes therefrom since claim 8 is a comprising-type of claim which does not exclude a third set of conductive pads. Lastly, while Shim does discloses a uniform center-to-center spacing between all of his lands 5, we see no limitation in claim 8 stating that the claimed first minimum distance must be different from the claimed second minimum distance. Thus, we agree with the examiner that the claimed first minimum distance can be equal to the claimed second minimum distance.[3] As such, claim 8 is clearly anticipated by Shim.

For the reasons set forth above, the subject matter of claim 8 is readable on Shim. Accordingly, claim 8 is anticipated by Shim. Therefore, the decision of the examiner to reject claim 8 under 35 U.S.C. § 102(b) is affirmed.

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[3] The United States Patent and Trademark Office (USPTO) applies to the verbiage of the claims before it the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the appellants' specification. In re Morris, 127 F.3d 1048, 1054, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997). See also In re Sneed, 710 F.2d 1544, 1548, 218 USPQ 385, 388 (Fed. Cir. 1983).

Claims 9 and 10

The appellants have grouped claims 8 to 10 as standing or falling together.[4] Thereby, claims 9 and 10 fall with claim 8. Thus, it follows that the decision of the examiner to reject claims 9 and 10 under 35 U.S.C. § 102(b) is also affirmed.

Claim 1

In our view, the subject matter of claim 1 is readable on Shim for the reasons which follow.

The appellants argue that Shim discloses a uniform center-to-center spacing between all of the lands 5 and thus does not disclose first and second sets of conductive pads with a first predetermined center-to-center spacing between each pad of the first set and the adjacent pad or pads of the first set and a second predetermined center-to-center spacing, less than the first spacing, between each pad of the second set and the adjacent pad or pads of the first and second sets. The appellants also argue that Shim does not anticipate claim 1 since Shim discloses more than two sets of conductive pads and that embodiment of Shim disclosed in Figures 5-11 does not include a passivation layer.

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[4] See page 5 of the appellants' brief.

We find these arguments of the appellants unpersuasive for the following reasons. First, we agree with the examiner that the passivation layer recited in claim 1 is readable on the insulating mask 6 depicted in Figure 11. Second, the claimed second predetermined center-to-center spacing being less than the first predetermined center-to-center spacing is readable on Shim as follows: the first set of conductive pads with a first predetermined center-to-center spacing between each pad of the first set and the adjacent pad or pads of the first set is readable on the two lands 5 having a diameter of d_1 (colored in blue and red and located on the red line in Exhibit A) and that the claimed second set of conductive pads is readable on Shim's lands 5 having a diameter of d_2 or d_3 (colored in yellow and located on the red line in Exhibit A). As such, the predetermined center-to-center spacing between each pad of the second set and the adjacent pad or pads of the first and second sets is less than the predetermined center-to-center spacing between the two pads of the first set. Lastly, we see nothing in this open-type of claim excluding other sets of lands.

For the reasons set forth above, the subject matter of claim 1 is readable on Shim. Accordingly, claim 1 is anticipated by Shim. Therefore, the decision of the examiner to reject claim 1 under 35 U.S.C. § 102(b) is affirmed.

Claims 2 and 3

The appellants have grouped claims 1 to 3 as standing or falling together.[5] Thereby, claims 2 and 3 fall with claim 1. Thus, it follows that the decision of the examiner to reject claims 2 and 3 under 35 U.S.C. § 102(b) is also affirmed.

The obviousness rejection

We will not sustain the rejection of claim 7 under 35 U.S.C. § 103 as being unpatentable over Shim.

In this rejection (answer, p. 5), the examiner ascertained that Shim did not disclose that the first set of pads is connected to one set of connection points in the integrated circuit and the second set of pads is connected to another set of connection points in the integrated circuit. The examiner then determined that it would have been obvious to so connect the first and second set of pads of shim.

In rejecting claims under 35 U.S.C. § 103, the examiner bears the initial burden of presenting a prima facie case of obviousness. See In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). A prima facie case of obviousness is

[5] See page 5 of the appellants' brief.

established by presenting evidence that would have led one of ordinary skill in the art to combine the relevant teachings of the references to arrive at the claimed invention. See In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988) and In re Lintner, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

In this case, it is clear that the examiner has not presented any evidence that would have led one of ordinary skill in the art to have modified Shim to arrive at the subject matter of claim 7. Accordingly, the examiner has not presented a prima facie case of obviousness. Therefore, the decision of the examiner to reject claim 7 under 35 U.S.C. § 103 is reversed.

New Ground of Rejection

Inasmuch as the basic thrust of our affirmance of the 35 U.S.C. § 102(b) rejection of claims 1 to 3 differs from the rationale advanced by the examiner for the rejection, we hereby designate the affirmance of the rejection of claims 1 to 3 to be a new ground of rejection pursuant to 37 CFR § 41.50(b) to allow the appellants a fair opportunity to react thereto (see In re Kronig, 539 F.2d 1300, 1302-03, 190 USPQ 425, 426-27 (CCPA 1976)).

CONCLUSION

To summarize, the decision of the examiner to reject claims 1 to 3 and 8 to 10 under 35 U.S.C. § 102(b) is affirmed and the decision of the examiner to reject claim 7 under 35 U.S.C. § 103 is reversed. The affirmance of the rejection of claims 1 to 3 has been designated to be a new ground of rejection pursuant to 37 CFR § 41.50(b).

Regarding the affirmed rejection, 37 CFR § 41.52(a)(1) provides "[a]ppellant may file a single request for rehearing within two months from the date of the original decision of the Board."

In addition to affirming the examiner's rejection of one or more claims, this opinion contains a new ground of rejection pursuant to 37 CFR § 41.50(b) (effective September 13, 2004, 69 Fed. Reg. 49960 (August 12, 2004), 1286 Off. Gaz. Pat. Office 21 (September 7, 2004)). 37 CFR § 41.50(b) provides "[a] new ground of rejection pursuant to this paragraph shall not be considered final for judicial review."

37 CFR § 41.50(b) also provides that the appellant, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options

with respect to the new ground of rejection to avoid termination of the appeal as to the rejected claims:

> (1) *Reopen prosecution.* Submit an appropriate amendment of the claims so rejected or new evidence relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the proceeding will be remanded to the examiner. . . .
>
> (2) *Request rehearing.* Request that the proceeding be reheard under § 41.52 by the Board upon the same record. . . .

Should the appellants elect to prosecute further before the examiner pursuant to 37 CFR § 41.50(b)(1), in order to preserve the right to seek review under 35 U.S.C. §§ 141 or 145 with respect to the affirmed rejection, the effective date of the affirmance is deferred until conclusion of the prosecution before the examiner unless, as a mere incident to the limited prosecution, the affirmed rejection is overcome.

If the appellants elect prosecution before the examiner and this does not result in allowance of the application, abandonment or a second appeal, this case should be returned to the Board of Patent Appeals and Interferences for final action on the affirmed rejection, including any timely request for rehearing thereof.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED-IN-PART; 37 CFR § 41.50(b)

JOHN P. McQUADE
Administrative Patent Judge

JEFFREY V. NASE
Administrative Patent Judge

JENNIFER D. BAHR
Administrative Patent Judge

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